

GEARTECH	QUALITY PROCEDURE	No. QP8702	SHEET 1 OF 4	
		Rev. A		
Inspection of Gear Tooth Contact Patterns with Hard Lacquer		BY RLE	DATE	8/13/02
		CKD JRM	DATE	8/13/02
<div>1. Scope</div> <div>1.1 This procedure covers inspection of gear tooth contact patterns using hard lacquer (DYKEM) under load with the gearset in a gear housing.</div> <div>2. Referenced Documents</div> <div>2.1 GEARTECH Specifications:</div> <div>CK8700 QP8700 Gear Tooth Contact Patterns.</div> <div>QP8702 Inspection of Gear Tooth Contact Patterns with Hard Lacquer.</div> <div>QP8704 Inspection of Gear Tooth Contact Patterns in a Gear Housing.</div> <div>3. Terminology</div> <div>3.1 DYKEM- Layout fluid in accordance with 5.1.</div> <div>3.2 Contact pattern- The pinion or gear tooth surface area where DYKEM is worn off.</div> <div>3.3 Gear housing- A gear housing in accordance with QP8704.</div> <div>3.4 Photograph- A permanent record obtained by photographing a contact pattern.</div> <div>3.5 Worst pattern- The contact pattern nearest to a boundary of a pinion or gear tooth at the tip, root, or end. The worst pattern does not necessarily cover the least area.</div> <div>3.6 Reference end- One end of the pinion and gear shall be designated the reference end. It can be identified by a unique feature such as long shaft extension, short shaft extension, or an etched unique mark.</div> <div>4. Significance and Use- See QP8700.</div> <div>5. Apparatus</div> <div>5.1 DYKEM- Contact pattern tests shall be performed using DYKEM Steel Blue Layout Fluid Part No. 80400, or DYKEM Steel Red Layout Fluid Part No. 80496, available from ITW Fluid Products Group, Glenview, IL, tel: (800) 443-9536. NOTE: DYKEM spray Part No. 80000 or Part No. 80096 shall not be used.</div> <div>5.2 DYKEM remover and thinner- If necessary, DYKEM shall be thinned with DYKEM remover and thinner available from ITW Fluid Products Group, Glenview, IL, tel: (800) 443-9536.</div> <div>5.3 Application brush- DYKEM shall be applied with a soft, fine-bristle brush. The brush size shall be adequate to allow painting an entire tooth with a single stroke.</div> <div>5.4 Brush container- The application brush shall be cleaned with DYKEM remover and thinner and stored in a clean, covered container whenever not in use.</div> <div>5.5 Camera- Contact patterns shall be recorded with color photographs taken with a digital or film camera.</div>				

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6.	Test Specimens			
6.1	Gearset- Contact pattern tests shall be performed on a gearset installed in a gear housing in accordance with QP8704.			
6.2	Test oil- Service oil shall be used for contact pattern tests unless the service oil is incompatible with DYKEM. Ester-based oils, synthetic polyalphaolefin (PAO) lubricants containing esters, and polyglycol (PAG) lubricants are incompatible if they are solvents for DYKEM. If the service oil is incompatible with DYKEM, a mineral gear oil shall be used for the tests. The test oil shall have the same viscosity as the service oil and adequate scuffing resistance.			
7.	Procedure			
7.1	Cleaning- Pinion and gear teeth shall be cleaned with a clean lint-free cloth soaked in fast drying solvent to remove oil, followed by a final cleaning with acetone to remove water. CAUTION: acetone is toxic and hazardous. Follow precautions given by the Material Safety Data Sheet (MSDS). The temperature of the pinion and gear shall be above the dew point. If any condensation is evident after cleaning, the pinion or gear shall be heated and the cleaning shall be repeated. Elapsed time between cleaning and application of DYKEM shall not exceed 5 minutes.			
7.2	Applying DYKEM to brush- Minimum brush load shall be adequate to allow painting an entire tooth with a single stroke. Maximum brush load shall be adjusted to prevent runs, sags, or an overly thick coating.			
7.3	Calibrating DYKEM thickness - Operator training and application technique shall be calibrated to maintain accuracy and repeatability of coating thickness. Proper coating thickness is achieved when gear tooth surface finish is clearly visible through the coating, and the coating is free of runs, sags, or thick areas. Viscosity of DYKEM shall be carefully controlled to ensure uniform and repeatable coating thickness. Viscosity may be reduced by mixing DYKEM with DYKEM remover and thinner.			
7.4	Applying DYKEM to pinion teeth- The load flanks of all pinion teeth shall be painted with DYKEM using the application brush. Application technique shall be carefully controlled so it is the same technique used during calibration in accordance with 7.3.			
7.5	Applying DYKEM to gear teeth- The load flanks of three adjacent gear teeth, in four equally spaced sectors, shall be painted with DYKEM using the application brush. Application technique shall be carefully controlled so it is the same technique used during calibration in accordance with 7.3.			
7.6	Verifying DYKEM adherence- After DYKEM has dried for at least 5 minutes, the coating shall be tested for adherence by wiping coated teeth with a clean, soft cloth using firm finger pressure. There shall be no DYKEM transfer to the cloth and no chipping of the DYKEM coating.			
7.7	Verifying DYKEM cleanliness- After DYKEM has dried for at least 5 minutes, the coating shall be tested for cleanliness by wiping coated teeth with light finger pressure. Sense of touch shall indicate a smooth, hard surface free of roughness or grit.			

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7.8	Applying oil to DYKEM- Immediately after the DYKEM coating has been verified in accordance with 7.6 and 7.7, all coated teeth shall be sprayed with test oil to prevent corrosion.		
7.9	Operating gearset- The gearset shall be operated with a series of loads such as 25%, 50%, 75%, and 100% of full load and contact patterns shall be documented in accordance with 9.1 after each load stage. Run time at each load shall be 20 minutes minimum. In some cases, longer run times are required to establish contact patterns, especially with high-speed gearsets and thick oil film thickness. For unidirectional gearsets, rotational direction shall be chosen to load the drive flanks of the gearset. For bi-directional gearsets, the procedure shall be repeated in the opposite direction.		
8.	Pinion tooth identification- Contact patterns on the pinion shall be visually inspected to find the tooth with the worst pattern in accordance with 3.5. This tooth shall be identified as tooth 1.		
8.1	Gear tooth identification- Contact patterns on the gear shall be visually inspected to find the tooth with the worst pattern in accordance with 3.5. This tooth shall be identified as tooth 1.		
8.2	Marking pinion tooth numbers- Tooth numbers shall be permanently marked on the reference end of four teeth equally spaced around the pinion starting with tooth 1. Teeth shall be numbered 1 through 4 clockwise looking from the reference end.		
8.3	Marking gear tooth numbers- Tooth numbers shall be permanently marked on the reference end of one tooth in each of the four sectors with DYKEM (see 7.5) starting with tooth 1. Teeth shall be numbered 1 through 4 clockwise looking from the reference end.		
9.	Recording Results		
9.1	Photographs- Photograph contact patterns on teeth 1 through 4 of the pinion and gear. The field of a photograph shall show the entire tooth. Large teeth may require close-up photographs of contact patterns in addition to overall photographs. Annotate photographs to identify pinion or gear, tooth number, tip, root, and reference end.		
10.	Interpretation of Results		
10.1	Photographs- The photographs shall be interpreted for percent contact area and worst pattern for the pinion and gear.		
11.	Acceptance Criteria		
11.1	Contact pattern- Contact patterns shall be within limits specified on engineering drawings for pinion and gear. In lieu of engineering specifications, worst patterns on the pinion and gear obtained under full load shall cover 75% of available tooth contact area. There shall be no contact at extremes of teeth near tip, root, or either end as evidenced by traces of DYKEM.		

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<div>12. Report</div> <div>12.1 The report shall include the following:</div> <div>12.1.1 Description of gearset,</div> <div>12.1.2 Description of gear housing,</div> <div>12.1.3 Description of test oil,</div> <div>12.1.4 Summary of test loads,</div> <div>12.1.5 Summary of run time at each test load,</div> <div>12.1.6 Annotated photographs,</div> <div>12.1.7 Summary of percent contact area and worst pattern for the pinion and gear,</div> <div>12.1.7 Record of verifications, and</div> <div>12.1.8 Record of calibrations.</div>				